Integrated Notification System for Smart Parking Security Using Bot Telegram

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Abstract: Notification system for smart parking system is very important for parking security. The purpose of this research is to create a system used in parking security in the technical faculty of mataram university. The method used in this research is the flow of making a notification system using a telegram bot, namely determining the notification using a telegram bot and then creating a telegram bot that will send notifications to security guards, after the bot has been created, then coding the notification system so that the notification can run according to existing rules. The results showed that the notification system made runs according to predetermined rules as seen from the success of sending notifications to the security guard group. The conclusion is that the use of this notification system is a solution to parking security problems. This notification system can provide accurate information to security officers regarding information on vehicle data mismatches and vehicle license plates so that vehicles in the parking area can be monitored.

Keywords: Bot; Notification; Smart parking; Telegram.

Introduction

Motorized vehicles are a very important means of transportation in everyday life, including in the university area. The increasing number of motorized vehicles used by students and lecturers in the university environment requires effective measures in maintaining parking security(Perangin-angin et al., 2023). However, with the growth in the use of motorized vehicles, parking security is becoming increasingly crucial and needs serious attention.

The University of Mataram area experienced three cases of motor vehicle theft that surfaced to the public. The first incident occurred around the campus rectorate building in 2019, the second case occurred in the Faculty of Economics area in 2019 and the third case occurred in the Faculty of Law parking area in 2017. This information is based on media reports (Harianto, 2019; LombokPost, 2019; SuaraNTB, 2017). The theft of motorized vehicles in the university area could happen again and become a serious threat to all vehicle owners. Currently, parking guards in the Mataram University area still rely on manual methods in securing motorized vehicles, such as visually guarding the parking area. This manual method is prone to human error and less efficient in dealing with emergency situations.

To overcome this challenge, a notification system is needed that can assist parking guards in improving the security of motorized vehicles in the university area(W. T. Sari, 2018). This notification system aims to provide a more effective and efficient solution in detecting potential cases of vehicle theft and providing a quick response to emergency situations. The main objective is to improve vehicle safety in the parking area of the Faculty of Engineering, Mataram University, especially motorcycles.

This system will use the telegram application as a notification platform(Fernando et al., 2020). Telegram is one of the most popular instant messaging applications due to its many advantages, such as the ability to send

messages in real-time, group messages in the form of channels, and security features (Ishaq & Firmansyah, 2023). In this research, Telegram allows the notification system to send information instantly to the security guard, if the system finds a security threat such as a motorist's face that is not registered in the database or an unverified vehicle license plate number.

The notification system will also use machine learning technology to detect the driver's face and read the vehicle license plate automatically through CCTV cameras installed in the parking area(Jonathan et al., 2023; Lambacing & Ferdiansyah, 2020). Previously, every student and lecturer who owns a motorcycle will register by entering their face photo and vehicle license plate number into the system database. The system will detect the faces of riders using helmets without masks and helmet covers. System validation will use data in the database, and notifications will be delivered in real-time via Telegram(Muid, 2022; Sholahuddin et al., 2023).

The way this notification system works is as follows: when a motorist is about to leave the faculty area, the CCTV camera will detect the motorist's face and read the vehicle license plate (Agung Laksono et al., 2023; Franseda et al., 2017). The system will then compare the data with the database containing the registered driver's information. If a condition occurs where the vehicle plate is detected in the database but the driver's face is not registered, or vice versa, the system will automatically send a real-time notification to the parking guard as a preventive and responsive action.

With this notification system, it is expected that parking guards will get accurate and fast information about potential security threats to motorized vehicles(Sharma & Kaushik, 2019; Siegel et al., 2018). This will enable parking guards to take appropriate actions, such as requesting further identification of suspicious motorists or contacting the authorities if necessary(Novrial & Gloria Octavia, 2021).

Thus, this research is expected to make a positive contribution in improving the security of motorized vehicle parking in university areas, especially Mataram University. with the benefits of increasing the author's knowledge, supporting security at the University of Mataram, and providing preventive measures for the community against potential motor vehicle theft. The use of machine learning technology in the notification system can help optimize the process of securing motorized vehicles, so that cases of vehicle theft can be suppressed and the university area becomes safer and more comfortable for all motorized vehicle users(Mustofa et al., 2023).

Telegram, a social media app introduced approximately in 2013, is among the array of social networking platforms launched during that time(Megalina et al., 2023). Telegram Messenger is an instant messaging app similar to WhatsApp, Line, and BBM (Blackberry Messenger). It uses the proven MTP protocol for end-to-end encryption (Miculan & Vitacolonna, 2023). Telegram Messenger incorporates location, photo, and video tagging with similar applications (Siswanto et al., 2020). In addition, this instant messaging platform can be used on the Raspberry Pi operating system (OS), and has a Telegram Bot feature that allows users to execute various commands. Telegram Messenger is very popular due to its open source nature. This is because users can view the source code, protocols, and Application Program Interface (API) of the application and create additional applications (Rifandi et al., 2021).

One of the features of the Telegram Messenger LLP API is Telegram Bot. Telegram Messenger LLP provides Telegram Bot Application Programming Interface (API), an open source technology that allows developers to create bot applications on the Telegram platform (Istiana et al., 2020). The API serves as an HTTP-based interface that connects a developer's bot to the Telegram system. One of the advantages of the Telegram API is that the public can use it (Lenardo et al., 2020).

Notification is a service that is often used for the purpose of providing notifications via short messages that can be accessed via smart devices (smartphones) (Alhady et al., 2022). Short messages called push notifications appear on the screen of a mobile device without a user request. Push notifications are usually pop-ups and can be received at any time, even when a transaction is in progress. Companies use them for various purposes, such as promoting products, providing customers with more convenience, and speeding up the transaction process. They keep appearing even when the user is not using the sender's app (Triawan & Siboro, 2021).

Improvements in computer vision processing and digital video camera technology have driven progress in the development of face recognition technology, which has been the subject of ongoing research with various approaches showing significant development (Khan et al., 2024). Face Recognition is a biometric method that allows computers to recognize human faces(Kumaran et al., 2021; Setiawan & Agushinta R, 2020). Face recognition systems often face problems such as facial expressions, illumination, and distance, but multi-face recognition allows the system to distinguish between recognized and unrecognized faces(Immanuel et al., 2024). Although widely used in places such as workplaces, public transportation, and stores, this biometric technology is still less accurate than other biometric methods (Andrejevic & Selwyn, 2020; Indriawan et al., 2022).

A database is a collection of data that is stored on a computer and can be commanded and retrieved by

programs(Purwantoro et al., 2023; Tarigan & Sembiring, 2023). The term "database" was first used in computer science to refer to electronic databases. However, before the digital age, database-like records have existed in the form of books and business data sets(Suryani et al., 2019). The relationships that exist between database entries can be used as data sources. Access, alteration, and data leakage are database security concerns. A collection of logically connected data to meet specific information needs is called a database (Aswiputri, 2022; Ramadhan & Mukhaiyar, 2020).

Cloud computing is a paradigm in which data is permanently stored on the user's computer and stored on Internet servers(Kholil & Mu'min, 2018). It is also a combination of computing with internet-based networking to run computer applications. The technology is a hidden infrastructure abstraction that allows people to access the Internet without knowing about the processes, infrastructure, and technology involved (Nugroho et al., 2019).

Cloud computing is a combination of computing that runs over an internet-based network. It is also a hidden infrastructure abstraction technology, which allows users to access the Internet without knowing the processes, infrastructure or technology involved (Surtahitu et al., 2019).

Method

In this study, the following flow is used as a guide to carry out research so that the achievement of predetermined goals can be carried out as desired. The research phases are depicted in the flowchart presented in Figure 1.
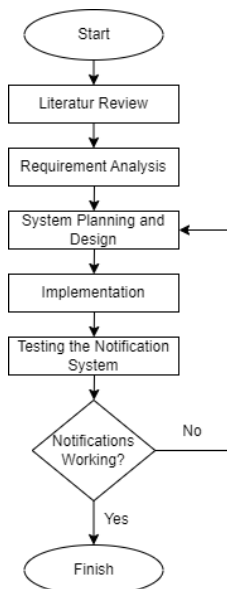

Figure 1. Research Flowchart

Literatur Review. The first step in this research is a literature review. The literature review aims to collect various data in advance and understand the concepts presented in various scientific journals, books, and previous research related to the development of notification systems using Telegram bots. Requirement Analysis. At this stage, a needs analysis is carried out in the development of a notification system in the form of data that is needed and related to the problem so that notifications sent to security guards can minimize the incidence of motorcycle theft and can improve parking security.

System Planning and Design. At the planning stage, this notification system will utilize the Telegram application as its notification platform. Telegram is a very well-known instant messaging application because it has many advantages, such as the ability to send messages in real-time, group messages in the form of channels, and has good security features. In this research, Telegram allows the notification system to send information instantly to security officers, if the system finds potential threats such as drivers who are not registered in the database or vehicle plate numbers that have not been verified.

At the design stage, this notification system is integrated with a smart parking system. Where this parking system uses CCTV to detect the faces and license plate numbers of motorists, then the detection results will be validated based on the face data and license plate numbers of motorists that already exist in the database. If the face data and license plate number detected do not match the face data and license plate number in the database, the telegram will send a real-time notification to the security guard as a preventive and responsive action and so that the security guard can quickly take action. as illustrated in the notification system design flow in Figure 2 (Patimah et al., 2022).
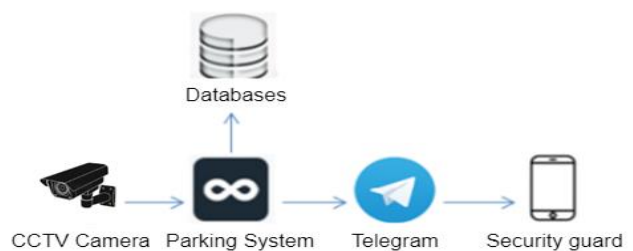

Figure 2. Design flow of Telegram notification system

In the next stage, namely creating a telegram bot to send notifications via telegram, we need a bot to connect the parking system with telegram. When creating a Telegram bot, the process begins by contacting the official Telegram bot account, @BotFather. By using the command to request the creation of a new bot, the user will obtain a token from the bot, which will later be used as a means to send notifications to the administrator. In addition to the token, the chat_id of the administrator's Telegram account is also required for the notification to

be received by the right party. To obtain the chat_id, users can call the Telegram API code getUpdates by including the token of the bot in question first. The notification data sent by the Telegram bot all comes from the same database that is used to store notifications from Snort, as illustrated in the process flow diagram in Figure 3. below (Nugroho et al., 2019).
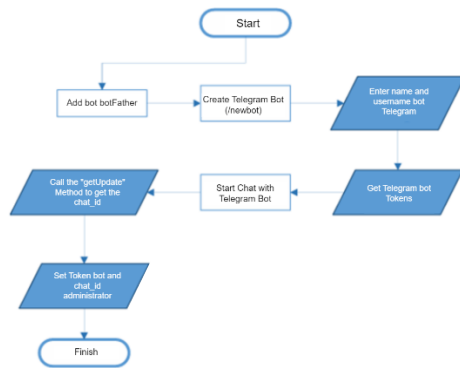

Figure 3. Flowchart of Telegram bot creation

Implementation. At the implementation stage, the developer will perform the notification system coding process. The coding process in the system implementation is carried out by the author as a developer so that telegram, database, face detection and vehicle license plate detection can be connected and become a notification system that will send notifications when the results of face detection and vehicle license plate detection are invalid with the data in the database.

Testing the Notification System. System testing is done using system functional testing. The function of this test is to test the notification system, whether the notification system has run according to the specified rules. Where the rule is that when the results of face detection and vehicle license plate detection are invalid with the data in the database, the telegram bot will send a notification to the security guard in the form of an image of the detected face and license plate and text explaining that the face and license plate of the vehicle are invalid.

Result and Discussion

This research is incorporated in an intelligent parking system where the intelligent parking system is divided into several studies such as face detection using helmets, detection of vehicle license plates, parking information systems, detection of empty parking spaces and parking notification systems. in this research, a parking notification system will be made where this notification system will send a notification to the security guard when the results of the rider's face and vehicle license plate do not match the existing data.

The notification system is made in accordance with the research flow chart listed in the previous chapter, namely in Figure 1. At this stage, we will explain the implementation and testing of the system design that has been made into a telegram bot that has successfully sent notifications to security guards (Hakim et al., 2020; Yoo et al., 2022).

Implementation. At this stage the implementation will be carried out from the flowchart that has been made in the research method as in Figure 3. to create a telegram bot.
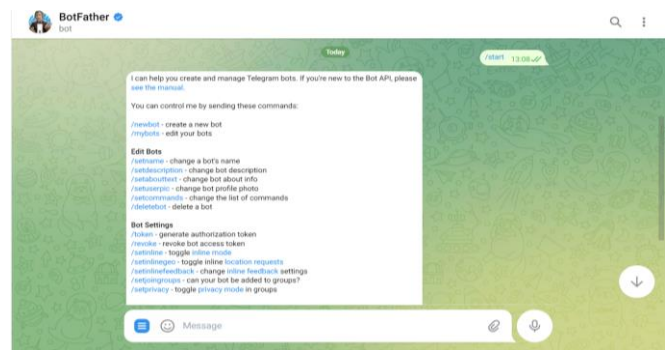

Figure 4. Start BotFather

First enter the telegram application and search for BotFather, after finding BotFather then use the /start command to start chatting with BotFather. Some commands suggested by BotFather will appear.
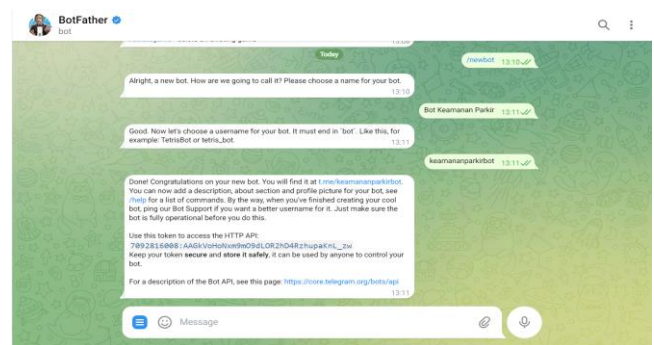

Figure 5. Create a new bot using BotFather

The next step is to use the "/newbot" command to create a new bot, after the command is executed we will be asked to enter the name of the new bot that we will create. After entering the name of the new bot that we want to create, we will be asked to enter the username of the new bot that we will create. After we enter the name and username of the new bot we want to create we will be given a token to access the HTTP API. The token that we have obtained will later be used to connect the notification system with telegram (telegram bot).

Figure 6. Calling method "getUpdates"

At this stage we call the "getUpdates" method to find out the chat_id of the group we will use to send notifications. In Figure 6. we find that the chat_id of the group we will use is "-4164893627". The chat_id that we have found will later be used as a link between the notification system and the group that we will use so that the notification that will be sent can be delivered to the group.

Testing the Notification System. At this testing stage, testing will be carried out on the notification system whether the notification system is able to send notifications according to predetermined rules, namely where when the results of face detection and vehicle license plate numbers are invalid, a notification will be sent to the security guard group.
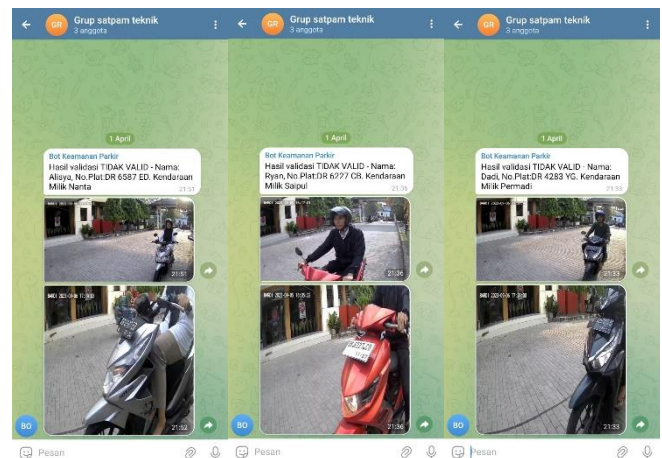

Figure 7. Testing 1 Notification System

In Figure 7. several experiments were carried out to send notifications of invalid face detection results and vehicle license plates where the face detection results produced unrecognized names and for vehicle owners namely Melki, Agus Dwi and Agus. in these three experiments the notification system successfully sent notifications in the form of text indicating that the face detection results and vehicle license plates were invalid, images of detected driver faces and images of detected vehicle license plates. The notification is sent because the detected driver's face rule does not exist in the database.

Figure 8. Testing 2 Notification System

In Figure 8. several experiments were carried out to send notifications of invalid face detection results and vehicle license plates where the face detection results produced the names Alisya, Ryan and Dadi and for vehicle owners namely Nanta, Saipul and Permadi. in all three experiments the notification system successfully sent notifications in the form of text indicating that the face detection results and vehicle license plates were invalid, images of detected driver faces and images of detected vehicle license plates. The notification is sent because the detected driver's face and vehicle license plate rules do not match the data in the database.
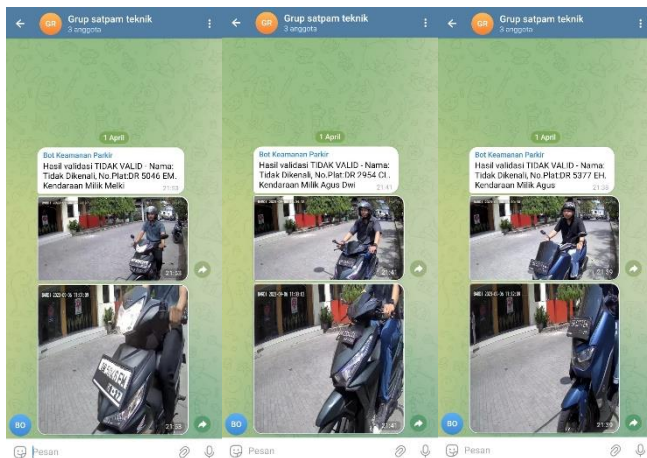
Conclusion

Based on research on notification systems using telegram bots integrated with intelligent parking security systems that have been carried out, it can be concluded that the use of this notification system is a solution to parking security problems. This notification system can provide accurate information to security officers regarding information on vehicle data mismatches and vehicle license plates so that vehicles in the parking area can be monitored.

Author Contributions
The preparation of this paper was facilitated by the guidance of two supervisors, namely Ida Bagus Ketut Widiartha, ST, MT, Ph.D. and Ariyan Zubaidi, S.Kom., MT. and add to the discussion Muhammad Taufik, M.Si.

Conflicts of Interest
No conflicts of interest

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